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### CONTRIBUTIONS TO THE FLORA OF VERMONT

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#### ABSTRACT

Recent herbarium and field studies have added 38 species and deleted 192 species from the flora of Vermont. The additions include 25 recently discovered species and 13 species based on older records that have been overlooked or misinterpreted. Ten additions are rare native species. Four of these are currently listed as state Threatened or Endangered species. The additions bring the total flora of Vermont to approximately 1933 species. The 192 deleted species, if included in the flora, would increase this number by 10%. The deletions include misidentified and misinterpreted species, cultivated plants incorrectly listed as naturalized, and many species that lack vouchers altogether. The geography of the added and deleted records suggests that many of the added species may be recent immigrants, and that many of the unvouchered species are highly unlikely in Vermont and are probably mistakes. A review of the number of species that have been deleted from the seven previous Vermont floras suggests that the apparent error rates of these floras have ranged from 0.3% to 5.4% of the species listed by each flora, with an average error rate of 2.4%.

**Key Words:** flora, additions, deletions, endangered species, discovery rate, error rate, immigration, Vermont

#### INTRODUCTION

In the last 150 years Vermont has had seven annotated floras and one checklist (Oakes, 1842; Torrey, 1853; Perkins, 1888; Brainerd et al., 1900; Eggleston et al., 1915; Dole, 1937; Seymour, 1969; Atwood et al., 1973), giving it the most extensively described flora of any state in the country. The authors are currently preparing a new checklist and flora. In the process we have compiled a number of recent unpublished additions to the flora and deleted a number of species credited to the flora in earlier works.

This paper lists those additions and deletions and, in the case of the deletions, gives our reasons for excluding them. The nomenclature follows that in Gleason and Cronquist (1991), except for a few cases in which we prefer the treatment of Kartesz (1994). Deleted species are listed under their current names<sup>1</sup>. When the names used in the original publications are different, these are placed in brackets. Common names for the species being added to the flora are taken from our forthcoming *Checklist of the Flora of Vermont*<sup>2</sup>.

We used the standard acronyms from *Index Herbariorum* (Holmgren et al., 1990) when citing herbaria in the section that follows. The herbarium of the Vermont Institute of Natural Sciences (VINS) is not listed in Holmgren et al. (1990).

#### ADDITIONS TO THE FLORA

This section includes 38 taxa, 15 native to the northeastern U.S. and 23 aliens. Nineteen of these additions are recently discovered species that have never been listed for Vermont. Six are recent records for species that were listed previously, but for which the earlier records were unacceptable for various reasons, most commonly because they were unvouchered or based on misidentifications. Four are older records that either have never been cited or have been cited incorrectly. Six have been cited correctly in previous Vermont floras, but omitted from recent monographs or from the most recent Vermont flora (Seymour, 1969) and checklist (Atwood et al., 1973). And three are new identifications of specimens that were previously misidentified.

This list does not include taxa (e.g., *Spiranthes ochroleuca* (Rydb.

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<sup>1</sup> In most cases the contemporary equivalents of the historical names are well known or can be found in historical manuals. Thus, synonyms for many of the names used by Oakes (1842) and Torrey (1853) can be found in the Fourth Edition of *Gray's Manual* (Gray, 1857), and those for many of the names used by Perkins (1888) and Eggleston and Brainerd (1904) in the Seventh Edition of *Gray's Manual* (Robinson and Fernald, 1908). In a few cases the historical names are obscure or were used incorrectly by 19th century authors, and it is hard to know exactly what plant the authors thought they had or what contemporary species most closely fits their concept. In such cases (for example *Thaspium trifoliatum* Gray var. *apterum* Gray) we have indicated that the synonym is uncertain.

<sup>2</sup> The *Checklist of the Flora of Vermont* (Jenkins and Zika, in prep.) has been in preparation for ten years and is expected to be published in the near future.

ex Britt.) Rydb., or *Hudsonia ericoides* L. spp. *intermedia* (Peck) Nickerson & Skog) that have been added to the flora because of taxonomic and nomenclatural changes.

In addition to the species listed in this paper, at least 51 other recent additions to the state flora have been published since the last checklist (Atwood et al., 1973). These may be found in Countryman (1978), Hellquist and Crow (1980), Wagner and Wagner (1982), Hellquist and Hilton (1983), Zika et al. (1983), Zika and Thompson (1986), Zika (1986B, 1987, 1988, 1990, 1991A, 1991B, 1992), Angelo (1989, 1990), Rothrock (1991), Zika and Marshall (1991), Paris (1991), Haufler and Windham (1991), Beitel and Mickel (1992), Farrar (1992), Reznicek and Oldham (1993), and Gilman (1993).

Ten of the taxa added here are rare native species with extant populations (*Asplenium montanum* Willd., *Carex atlantica* L. Bailey var. *atlantica*, *C. capillaris* L., *C. cumulata* (L. Bailey) Mack., *Dracocephalum parviflorum* Nutt., *Eleocharis robbinsii* Oakes, *Myrica pensylvanica* Mirbel., *Panicum flexile* (Gattinger) Scribn., *Potentilla pensylvanica* L., and *Vaccinium stamineum* L.). Four of these (*Asplenium montanum*, *Carex capillaris*, *Dracocephalum parviflorum*, and *Panicum flexile*) are currently listed as state Threatened or Endangered species (10 V.S.A., Chapter 123). We have recommended to the Vermont Endangered Species Committee that all of these species, with the exception of *Myrica pensylvanica*, be listed as state Threatened or Endangered species.

### Recently Discovered or Authenticated Species

*Ajuga reptans* L., Lamiaceae, carpet-bugle. **Windsor Co.:** roadside, South Woodstock, 1967 (*Ahles 68243* MASS); **Orleans Co.:** under raspberries, Lake Willoughby, Westmore, 1980 (*Zika 1354* MASS, VT).

*Alyssum saxatile* L., Brassicaceae, golden-tuft. **Chittenden Co.:** escape from cultivation, Shelburne, 1979 (*Zika 1291*, VT); **Addison Co.:** naturalized and common on limy ledges, Gardiners Island, Ferrisburg, 1980 (*Zika 1639* MASS, VT); 1981 (*Zika 4048* NEBC).

*Asplenium montanum* Willd., Aspleniaceae, mountain spleenwort. **Bennington Co.:** about 30 plants in cracks, dry sunny quartzite ledges, cliffs above Rattlesnake Brook, elev. 1000 feet, Pownal, 1974 (*Jenkins s.n.* VT).

- Cardamine impatiens* L., Brassicaceae, European bittercress. **Bennington Co.:** old railroad grade south of golf course, Bennington, 1979 (*Zika & Jenkins 1332 VT*); edge of a footpath, Bennington, 1985 (*Jenkins & Thompson s.n. VT*). Known since 1981 from two localities in adjacent White Creek, Washington Co., New York (*Zika & Jenkins 8024 VT*).
- Carex atlantica* L. Bailey var. *atlantica*, Cyperaceae, Atlantic sedge. **Franklin Co.:** Franklin Bog, Franklin, 1965 (*Seymour s.n. VT*); deep water of lag and central pools, with *Carex comosa* F. Boott and *C. interior* L. Bailey, several places, S. end of Franklin Bog, Franklin, 1982 (*Jenkins 82-176 VT*); ten clumps, N. end of Franklin Bog, Franklin, 1982 (*Zika 6115 VT*); **Bennington Co.:** sedge-alder swamp, with *Carex stricta* Lam. and *C. stipata* Muhl., near a sandy field, N. Pownal, 1982 (*Jenkins 82-155 VT*). Determinations based on keys in Reznicek and Ball (1980).
- Carex capillaris* L., Cyperaceae, hair-like sedge. **Caledonia Co.:** limy seepage area near Route 2, with *Equisetum variegatum* Schleich., and *Eleocharis tenuis* (Willd.) Schultes var. *borealis* (Svenson) Gleason, Danville, 1985 (*Zika 9040 VT*). Discovered here by T. Rawinski in 1984. Reported from northern Vermont by Fernald (1950), but vouchers never located.
- Carex cumulata* (L. Bailey) Mack., Cyperaceae, sedge. **Windham Co.:** sandy bluff, eroding bank of Connecticut River, with *Leptoloma cognatum* (Schultes) Chase, *Paspalum setaceum* Michx. var. *ciliatifolium* (Michx.) Vasey, *Cyperus filiculmis* Vahl, and weeds, Rockingham, 1989 (*Thompson & Rawinski 2307 VT*, Det. A. A. Reznicek, 1990); among granite boulders in steep oak woods, with *Pinus rigida* Miller, Black Mountain, Dummerston, 1991 (*Jenkins s.n. VT*).
- Carex spicata* Huds., Cyperaceae, sedge. **Rutland Co.:** rough limy meadow west of the south end of Shaw Mt., West Haven, 1990 (*Thompson 90-52 VT*); limy meadow by Catfish Cove, Mt. Independence, Orwell, 1990 (*Jenkins s.n. VT*). The two colonies are within 10 miles of each other and both consist of a few clumps of the sedge within a few square meters.
- Eleocharis robbinsii* Oakes, Cyperaceae, Robbin's spike-rush. **Rutland Co.:** locally abundant, shallow water adjacent to boggy shore, with *Nuphar*, *Utricularia gibba* L. and *Potamogeton epihydrus* Raf., east shore of Little Lake, Wells, 1989 (*Jenkins s.n. VT*).

- Erucastrum gallicum* (Willd.) O. E. Schulz, Brassicaceae, dog mustard. **Orleans Co.:** lower slope of Mt. Pisgah, Westmore, 1973 (*Hodgdon et al. 19983 NHA*). Vouchers for stations reported by Dole (1937) have not been found.
- Hieraceum flagellare* Willd., Asteraceae, whiplash hawkweed. **Windham Co.:** roadside, junction of Routes 103 and Interstate 91, Rockingham, 1979 (*Ahles 86816 MASS, VT*); **Windsor Co.:** roadside, Route 103, Chester, 1979 (*Ahles 86783 MASS*).
- Iris sibirica* L., Iridaceae, Siberian iris. **Windham Co.:** roadside, Rockingham, 1979 (*Ahles 86823 MASS*); **Chittenden Co.:** naturalized in a damp meadow, Shelburne, 1981 (*Zika 4013 VT*); sandy lot by airport, South Burlington, 1985 (*Zika 9062 VT*).
- Kolkwitzia amabilis* Graebn., Caprifoliaceae, beauty-bush. **Chittenden Co.:** apparently spreading from cultivation into thickets, Rock Point, Burlington, 1981 (*Zika 4706 VT*).
- Lavandula angustifolia* Mill. [*L. officinalis* Chaix., *L. spica* L., *L. vera* DC.], Lamiaceae, lavender. **Windham Co.:** escaped in field, Guilford, 1982 (*Zika 6547 VT*). Earlier reports of *L. spica* (Atwood et al., 1973) are based on collections from cultivated plants.
- Lysimachia vulgaris* L., Primulaceae, garden loosestrife. **Bennington Co.:** roadsides, Pownal, 1967 (*Ahles 67959 MASS*); **Windsor Co.:** naturalized, Connecticut River shore, near mouth of Lulls Brook, Hartland, 1982 (*Zika 6220 VT*); **Washington Co.:** roadside weed, Plainfield, 1980 (*Zika 1654 VT*); **Windham Co.:** common on Connecticut River shore, two miles south of Bellows Falls, Westminster, 1982 (*Zika 6269 VT*).
- Mentha × villosa* Hudson [*M. alopecuroides* Hull], Lamiaceae, foxtail mint. **Washington Co.:** railroad yard, Montpelier, 1975 (*Ahles 81496 MASS*); **Windham Co.:** weed, sandy dump, Brattleboro, 1982 (*Zika 6461 NEBC, VT*).
- Myosotis micrantha* Pallas [*M. stricta* Link], Boraginaceae, blue scorpion-grass. **Chittenden Co.:** lawn weed, North Beach Campground and Lakeview Cemetery, Burlington, 1980 (*Zika 1330 & 1370 VT*); weed, Horsford Nursery, Charlotte, 1984 (*Zika 7988 VT*). An earlier record for Burlington (*Seymour 23094 MO*), cited in Seymour (1982), is based on a specimen of *M. arvensis* (L.) Hill.

- Myrica pensylvanica* Mirbel., Myricaceae, bayberry. **Chittenden Co.:** five clones, ca. 120 ramets, overgrown hillside pasture north of Rt. 2, with *Acer rubrum* L., *Berberis*, *Crataegus*, *Pinus strobus* L., *Rubus*, Richmond, 1992 (*Marshall 2446* VT). First observed in 1989 by Everett J. Marshall.
- Panicum flexile* (Gattinger) Scribn., Poaceae, panic grass. **Rutland Co.:** common, sunny limestone ledges, Shaw Mountain, West Haven, 1983 (*Jenkins & Zika 7665* NEBC, VT). Previous reports for Grand Isle are based on a sheet of *P. capillare* L. (*Hunnewell 13908* NEBC). *Panicum flexile* has long been known from Skene Mountain, in Whitehall, N. Y., about 10 miles south of Shaw Mountain, where a small population still persisted in 1987 (Jenkins and Zaremba, pers. obs.).
- Pimpinella saxifraga* L., Apiaceae, burnet saxifrage. **Bennington Co.:** along abandoned railroad grade, Bennington, 1975 (*Jenkins s.n.* VT). First discovered at this site by Barbara Beecher in 1975. Apparently not extant in August 1985.
- Polygonum sachalinense* F. W. Schmidt, Polygonaceae, giant knotweed. **Addison Co.:** Granville, 1983 (*Zika 7189* VT); **Lamoille Co.:** roadsides of Route 108 near Mt. Mansfield, Stowe, 1980 (*Zika 2224, 4752* MASS, NEBC, VT); Stowe, 1981 (*Angelo et al., s.n.* NEBC); Wolcott, 1983 (*Zika 7486A* VT); **Washington Co.:** railroad yard, Roxbury, 1982 (*Zika 6760* VT); **Windsor Co.:** railroad yard, White River Junction, 1981 (*Zika 5336* NEBC, VT).
- Potentilla pensylvanica* L., Rosaceae, Pennsylvania cinquefoil. **Washington Co.:** hilltop pasture, Plainfield, 1968 (*Jenkins s.n.* VT). Colony extant but very small in September 1987.
- Setaria faberi* R. Herrm., Poaceae, giant foxtail. **Addison Co.:** New Haven Junction, 1981 (*Zika 5258* VT); Middlebury, 1981 (*Zika 5263* VT); Ferrisburg, 1981 (*Zika 5292* VT); **Bennington Co.:** Bennington, 1984 (*Zika 8263* VT); **Chittenden Co.:** Burlington, 1980 (*Zika 1913* VT); Jericho, 1981 (*Zika 5185* VT); **Franklin Co.:** St. Albans, 1981 (*Zika 5177* VT); **Rutland Co.:** Rutland, 1981 (*Zika 5270* VT); **Washington Co.:** Waterbury, 1979 (*Zika 1228* VT); **Windham Co.:** Brattleboro, 1981 (*Zika 5339* VT); **Windsor Co.:** White River Junction, 1981 (*Zika 5132* VT). This species apparently has increased rapidly in New York since 1940 (Smith, 1965) and has been spreading rapidly in Vermont since about 1970 (W. D. Countryman, pers. comm.). At present it is a widespread pest on railroad easements, agricultural lands, and roadsides,

where it is frequently associated with *Setaria glauca* (L.) P. Beauv., *S. viridis* (L.) P. Beauv., *Aristida* spp., *Panicum dichotomiflorum* Michx., or *Kochia scoparia* (L.) Schrader.

*Vaccinium stamineum* L., Ericaceae, deerberry. **Bennington Co.:** one bush in rocky woods above River Road, North Pownal, 1986 (*Jenkins s.n.* VT). Brainerd et al. (1900) noted in the appendix to their flora that *V. stamineum* was known from Mt. Greylock in Williamstown, Massachusetts, and should be sought in Vermont. A record from Wells River, Vermont, in Dole (1937) was not supported by a herbarium specimen.

*Verbena stricta* Vent., Verbenaceae, hoary vervain. **Chittenden Co.:** weed in cracks in asphalt, Troy Ave., Colchester, 1981 (*Zika 4234* VT).

### Older Records, Not Previously Cited

*Asclepias verticillata* L., Asclepiadaceae, whorled milkweed. **Windsor Co.:** Windsor, undated (*Alphonso Wood s.n.* NY). Although the Windsor collection lacks a date and was not cited in any previous Vermont flora, we accept the record because the specimen is correctly identified and geographically plausible. A collection by C. C. Frost from Brattleboro cited in early floras has not been found.

*Dioscorea batatas* Decne., Dioscoreaceae, Chinese yam. **Windham Co.:** Townshend, 1922 (*L. A. Wheeler s.n.* NEBC). Marginal addition, probably short-lived, as Wheeler's label reads: "temporary escape."

*Hieracium murorum* L., Asteraceae, golden lungwort. **Rutland Co.:** Center Rutland, 1947 (*Kirk s.n.* TUFT).

*Rhododendron periclymenoides* (Michx.) Shinnars [*Rhododendron nudiflorum* (L.) Torr.], Ericaceae, pinkster-flower. **Caledonia Co.:** Peacham, 1891 (*F. Blanchard s.n.* NY). All records of this species cited in previous floras are based on specimens of *R. prinophyllum* (Small) Millais [*R. roseum* (Loisel.) Rehd.].

### Older Records, Cited by Previous Floras, But Omitted From Recent Floras or Monographs

*Carex atlantica* L. Bailey var. *capillacea* (L. Bailey) Cronq. [*C. howei* Mackenzie], Cyperaceae, Howe's sedge. **Chittenden Co.:** Colchester, 1899 and 1907 (*Flynn s.n.* VT); S. Burlington,

1896 (*Flynn s.n.* VT). Not cited for Vermont by Reznicek and Ball (1980).

*Carex wiegandii* Mackenzie, Cyperaceae, Wiegand's sedge. **Windham Co.:** Torrey Meadow, Stratton, 1895 (*Grout s.n.* VT); **Chittenden Co.:** Star Farm, Burlington, 1906 (*Flynn s.n.* VT). Listed in Seymour (1969) and Atwood et al. (1973), but not cited for Vermont by Reznicek and Ball (1980).

*Dracocephalum parviflorum* Nutt., Lamiaceae, American dragonhead. **Windsor Co.:** potato field, Billings Farm, Woodstock, 1921 (*Kittredge s.n.* VINS); **Rutland Co.:** West Clarendon, 1915 (*Potter s.n.* TUFT); dry rocky slope in full sun, Twin Mountain, West Rutland, 1983 (Jenkins, pers. obs.). Cited by Kittredge (1931) and Dole (1937), but not in subsequent works.

*Geum vernum* (Raf.) T. & G., Rosaceae, spring avens. "Vermont": undated collection (ex herb. *Torrey* VT); **Bennington Co.:** fertile ground among wrecked cars, 100 m. north of the North Bennington post office, with *G. canadense* Jacq., *Chenopodium gigantospermum* Aellen and weeds, Bennington, 1985 (*Zika 9087* VT). *Torrey's* sheet, presumed to have been made in the 1800's, was reported in Seymour (1967), but not in previous floras or Atwood et al. (1973). The North Bennington colony was discovered by J. Jenkins and had both flowers and fruits on 5 June 1985. The species is not otherwise known from New England, but occurs occasionally in eastern New York (Jenkins, pers. obs.).

*Primula veris* L., Primulaceae, primrose. **Chittenden Co.:** garden escape, Burlington, 1898 (*Jones s.n.* VT). Cited in Dole (1937), but omitted from recent floras.

*Tagetes patula* L., Asteraceae, French marigold. **Windsor Co.:** riverbank, Billings Farm, Woodstock, 1918 (*Kittredge s.n.* VINS). Cited by Dole (1937), but not in subsequent works.

### Plants Incorrectly Determined in Previous Floras

*Delphinium orientale* J. Gay [*Consolida orientalis* (J. Gay) Schröding], Ranunculaceae, rocket larkspur. **Chittenden Co.:** roadside escape, Charlotte, 1903 (*Flynn s.n.* VT). Previously reported as *Delphinium ajacis* L.

*Prunus cerasus* L., Rosaceae, sour cherry. **Bennington Co.:** Manchester, 1898 (*Day 371* NEBC). The specimen was labelled



as *P. avium* L. and was cited under this name in previous floras. Harry Ahles annotated it to *P. cerasus* in 1975. A Brainerd specimen of *P. cerasus* from Middlebury, cited in Dole (1937), has not been found.

*Solanum sarrachoides* Sendtner, Solanaceae, hairy nightshade. **Chittenden Co.:** garden weed, Westford, 1969 (*Meunier s.n.* VT). Previously reported as *S. villosum* Mill. (Seymour, 1969).

#### DELETIONS FROM THE FLORA

This section lists 192 species, credited to Vermont in publications or represented by herbarium specimens, that we have either proven to be erroneously credited to the state or have been unable to validate. These we are deleting from the flora. In doing so we are not asserting that the species has never occurred in Vermont, but only that the historical reports are apparently unverifiable or in error. The deletions do not include taxa (like *Antennaria brainerdi* Greene or *Aster pringlei* (Gray) Britton) that were formerly listed for Vermont but are now included in other species.

Species have been deleted for any of six reasons<sup>3</sup>. The commonest reason is that no specimen was found (NSF). For 130 of the deleted species we were unable to locate vouchers to support one or more of the published records. Ninety-six of these species lacked vouchers altogether and another 34 lacked vouchers for one or more of the reported stations.

Interestingly, only 19 of the species that lack vouchers for one or more sites are cited in the floras whose authors required vouchers for all the species they listed (Brainerd et al., 1900; Eggleston et al., 1915; Seymour, 1969; Atwood et al., 1973); in these cases

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<sup>3</sup> The claim that a species is or was present in Vermont is usually based on one or more published records, which may or may not cite individual specimens. We delete a species only after we have either looked for and found no corroborating specimens or have examined and rejected all the specimens we have found. The reasons for rejecting specimens vary: some can't be found; others are misidentified; others are rejected because they were cultivated, incorrectly cited, or otherwise dubious (see main text). Because the decision to reject a species usually rests on the rejection of several specimens or citations, a species may be deleted for a combination of reasons. Thus we say, for example, that some species lacked vouchers altogether, while others lacked vouchers for one or more stations. In the latter cases, the stations with vouchers would have been deleted for other reasons.

it is likely that the original specimens cited in these floras have since been lost or redetermined. The remaining 111 species which lack one or more vouchers were cited in works (Oakes, 1842; Torrey, 1853; Perkins, 1988; Dole, 1937) that included unvouchered records. In many of these cases we suspect that no specimen was ever seen by the authors of the floras.

The second most common reason for deleting species is that they are misidentified (MI). For 50 deleted species one or more vouchers were misidentified. These include 28 species for which all the published records were misidentifications and another 22 species for which all the vouchers we could locate were misidentified.

A third group of deletions are cultivated species that are not provably naturalized. To list a cultivated species in the flora, we require evidence that it has spread (though not necessarily persisted) beyond the immediate area where it was cultivated. Many collectors made specimens of cultivated plants; and, in the absence of information about where a specimen was collected, the mere presence of a specimen of a cultivar in a herbarium does not prove that the plant was naturalized. A total of 31 deleted species fall in this category. Twenty of these are based on specimens that are almost certainly from cultivated plants (CULT), and another 11 are based on specimens whose labels lack habitat information and so are not definitely naturalized (NDN).

A fourth group of deletions includes 15 records based wholly or partly on specimens that were correctly determined by their collectors, but incorrectly cited or attributed to Vermont in subsequent floras (IC). Examples include a specimen of *Erigeron acris* L. from the St. Johns River in Maine which was relabeled and credited to the St. Johnsbury Railroad in Vermont and, less dramatically, a number of cases where the old and new names for a plant were listed in the same work as two separate species. When one name is obsolete, this causes no real problems. But in cases (e.g., *Cardamine flexuosa* With., *Amelanchier canadensis* (L.) Medikus, or *Carex saxatilis* L.) where one of the names is now used for a species that doesn't occur in Vermont, this practice can lead to significant errors, particularly when these records are cited in regional floristic works.

A fifth group of deletions includes five species for which some or all of the specimens are inadequate (IS) because they are immature, sterile, fragmentary, or otherwise undeterminable. These are mostly species that closely resemble a common Vermont spe-

cies. Examples are *Lepidium ruderale* L., sterile plants of which resemble the common *L. densiflorum* Schrader, and *Salix serrissima* (L. H. Bailey) Fern., whose immature leaves closely resemble those of the common *Salix lucida* Muhl.

The last group of deletions includes five species in which one or more specimens are correctly determined, but not provably from Vermont, that is, the collection data is not convincing. We call these specimens of doubtful provenance (DP). Our reasons for rejecting them—which are inferential and not conclusive—are different in each case and are summarized in the entries for those species.

Each of the following entries gives a) the species deleted; b) the publications (if any) that cited the record; c) in bold type, the locality to which the plant was credited, or NL if no locality was given, or an abundance in quotation marks if that is the only distributional information in the original publication; d) the collector of the specimen on which the record is based (or NCC when no collector was cited in the publication) and the herbarium holding that specimen (both in parentheses); and e) our reason for deleting the record. When the current name differs from that used in the original publication, we give the older name in square brackets. When no herbarium is listed, it means that we found no specimen and are listing the locality and collector credited in the original publication. For readability, we use the following abbreviations.

**Publications:** A, Atwood et al. (1973); AM, Ames (1910); B, Brown (1964); BR, Brainerd et al. (1900); C, Countryman (1978); CR, Crow (1982); D, Dole (1937); E, Eggleston et al. (1915); EB, Eggleston and Brainerd (1904); F, Fernald (1950); FL, Flynn (1911); G, Gleason and Cronquist (1991); I, Cronquist et al. (1977); J, James (1823); JE, Jesup (1891); K, Kennedy (1904); KI, Kittredge (1931); KS, Kittredge (1939); LI, Little (1977); O, Oakes (1842); P, Perkins (1888); PE, Pennell (1935); S, Seymour (1969); T, Torrey (1853); W, Watson and Coulter (1890).

**Reasons for deletions:** CULT, cultivated; DP, doubtful provenance; IC, incorrectly cited; IS, inadequate specimen; MI, misidentified; NDN, not definitely naturalized; NSF, no specimen found.

*Allium porrum* L. [*A. fistulosum* sensu Dole (1937), not L.], **A, S, Manchester**, (Day NEBC, GH), MI = *A. cepa* L. or *A. fistulosum* L.

- Amaranthus cannabinus* (L.) Sauer [*Acnida cannabina* L.], D, **Woodstock**, (Kittredge), MI = *Amaranthus rudis* Sauer ?; NL (ex herb. Torrey, VT), MI = *Amaranthus tuberculatus* (Moq.) Sauer [*Acnida altissima* (Riddell) Moq. ex Standl.].
- Amaranthus powellii* S. Wats., D, **Woodstock**, (Kittredge), NSF.
- Amelanchier canadensis* (L.) Medikus, A, S, **14 sites**, (several collectors, VT), IC = *A. arborea* (Michx. f.) Fern. The name *A. canadensis*, which formerly included the Vermont plants now attributed to *A. arborea*, is restricted to plants of the coastal plain.
- Anchusa arvensis* (L.) M. Bieb. [*Lycopsis arvensis* L.], P, “**not common**,” (NCC), NSF; O, **Pownal**, (Reed), NSF; **Middlebury**, (Dodge VT), MI = *Lithospermum officinale* L.
- Antennaria virginica* Stebbins, D, **Middlebury**, (Brainerd), NSF; A, **North Dorset**, (Flynn VT), MI = *A. neglecta* Greene var. *neodioica* (Greene) Cronq.; A, **Vernon**, (NCC VT), NSF. See Bayer and Stebbins (1982).
- Aronia arbutifolia* (L.) Elliott [*Pyrus arbutifolia* (L.) L. f. var. *erythrocarpa* Gray], O, P, NL, (NCC), NSF; D, “**occasional**,” (NCC), NSF.
- Asclepias purpurascens* L., T, **Brattleboro**, (Frost), NSF; P, “**common**,” (NCC), NSF; D, KI, **Woodstock**, (Kittredge NY, Billings & Kittredge VINS), both MI = *A. syriaca* L.; C, S, **Essex**, (Carpenter VT), MI = *A. syriaca*; **Burlington**, (Ayer & Sullivan VT), MI = *A. syriaca*.
- Aster ciliolatus* Lindley [*A. lindleyanus* T. & G.], D, S, **Ripton**, (NCC), NSF; A, D, E, **South Bellows Falls**, (Blanchard), NSF; D, **Burlington**, (Dole), NSF; A, D, **Middletown Springs**, (Carpenter VT), MI = *A. cordifolius* L.; **Bellows Falls**, (Potter VT), MI = *A. cordifolius*.
- Aster dumosus* L., D, **Hartland**, (Eggleston), NSF; D, **Westminster**, (Blanchard VT), MI = *A. racemosus* Elliot [*A. vimineus* L. of Vermont authors]; D, **Wells River**, (Smith), NSF; **Vernon**, (Blanchard VT), MI = *A. racemosus*; **Rutland**, (Eggleston HNH), MI = *A. cordifolius* L. × ? *A. pilosus* Willd.
- Aster foliaceus* Lindley ex DC., A, S, **West R. & Connecticut R.**, (several collectors, HNH, NEBC, VT), MI = *Aster novi-belgii* L. Large populations of a plant related to *Aster novi-belgii* occur along the West and upper Connecticut Rivers. The plants have the slightly enlarged and veiny outer bracts of

the boreal species *A. foliaceus*, but resemble *Aster novi-belgii* in other features and differ in leaf shape and bract width from Canadian and cordilleran material of *A. foliaceus*. Measurements from 50 West River collections (Jenkins, unpubl. data) show that the plants with broader bracts that have been called *A. foliaceus* grow mixed with typical *A. novi-belgii*, and that intermediates occur. On the basis of this evidence, we refer all Vermont collections of *A. foliaceus* to *A. novi-belgii*, noting that *A. novi-belgii*, which is known to be quite variable, can have outer involucral bracts to 2.0 mm wide which are more or less reticulately veined. This conclusion agrees with that of a brief study of specimens from the upper Hudson River (Jenkins, 1990, unpubl. report to the Adirondack Nature Conservancy, Keene) and an extensive study of plants from Quebec (Jacques Labrecque, pers. comm.).

*Aster infirmus* Michx., D, **Danville**, (*Drake*), NSF.

*Aster patens* Aiton, P, **NL**, (*Barrows*), NSF.

*Aster praealtus* Poiret, O, **Bellows Falls**, (*Carey*), NSF.

*Aster prenanthoides* Muhl., BR, E, **Newfane**, (*Grout*), MI = *A. novi-belgii* L. var. *tardiflorus* (L.) A. G. Jones; E, D, **Taftsville**, (*Darling*), NSF.

*Aster solidagineus* Michx. [*Sericocarpus solidagineus* Nees], P, “**not common**,” (*NCC*), NSF.

*Atropa belladonna* L., D, **Wells River**, (*Smith*), NSF. Besides *Atropa belladonna*, Dole (1937) reported *Gaylussacia frondosa* (L.) T. & G., *Vaccinium stamineum* L., and *Silene pensylvanica* Michx. from Wells River on the authority of W. P. Smith. All are native species and, excepting *Vaccinium stamineum* which was recently discovered in extreme southwestern Vermont (100 miles from Wells River), all are otherwise unknown in Vermont, geographically unlikely, and unsupported by vouchers or citations in other floras.

*Avena sterilis* L., A, **Charlotte**, (*Pringle* VT), CULT.

*Bidens comosa* (A. Gray) Wieg., D, **Middlebury** (*Brainerd*), NSF; A, S, **Vernon**, (*Eaton* NEBC), IS.

*Bidens laevis* (L.) BSP. [*B. chrysanthemoides* Michx.], P, “**wet places**,” (*NCC*), NSF; E, “**common**,” (*NCC*), NSF; D, **Middlebury**, (*Brainerd*), NSF; D, **Danville**, (*Drake*), NSF; **East Dorset**, (*Grout* VT), MI = *B. cernua* L.; **Middletown Springs**, (*Carpenter* VT), MI = *B. cernua*; **Rutland**, (*Kirk* VT), MI =

- B. cernua*. *Bidens laevis*, a rare species barely reaching our area, closely resembles the common *B. cernua* and probably was the species Perkins and Eggleston had in mind.
- Bromus arvensis* L., D, **Windham**, (*Blanchard*), NSF; **Brattleboro**, (*Ahles MASS*), MI = *B. japonicus* Thunb.
- Bromus hordaceus* L. [*B. mollis* L.], P, **NL**, (*NCC*), NSF.
- Calamagrostis cinnoides* (Muhl.) Bart. [*Deyeuxia nuttaliana* St., *C. nuttaliana* Steud.], D, JE, P, **Windsor**, (*Leland*), NSF.
- Calystegia hederacea* Wallich [*C. pubescens* Lindl., *Convolvulus japonicus* Thunb.], E, D, **NL**, (*NCC*), NSF.
- Cardamine flexuosa* With., D, **Wallingford**, (*Brainerd*), IC = *C. pennsylvanica* Muhl.; D, **Smugglers Notch**, (*Brainerd*), IC = *C. pennsylvanica*; KI, **Woodstock**, (*Kittredge*), NSF. See Kittredge (1936). The name *C. flexuosa*, which is now restricted to a plant of the southern U.S., was formerly used for broad-leaved forms of *C. pennsylvanica*.
- Cardamine rotundifolia* Michx., T, **Vermont**, (*Robbins*), NSF.
- Carex adusta* F. Boott, P, **Fairlee**, (*Blanchard*), NSF; P, **Middlebury**, (*Blanchard*), NSF.
- Carex atrata* L., I, **Vermont**, IC = *C. atratiformis* Britton.
- Carex bullata* Schk., D, **Sharon**, (*Dutton*), NSF; **Whitingham**, (*Ahles MASS*), MI = *C. vesicaria* L.
- Carex collinsii* Nutt., A, S, **Essex Co.**, (*NCC NEBC*), NSF; A, S, **Walden**, (*NCC NEBC*), NSF.
- Carex crawei* Dewey, P, **Charlotte**, (*Pringle*), NSF.
- Carex dioica* L. var. *gynocrates* (Wormsk.) Ostenf. [*C. gynocrates* Wormsk.], P, T, **Burlington**, (*Torrey*), NSF.
- Carex flaccosperma* Dewey [*C. glaucodea* Tuckerm.], D, **Leicester**, (*Dutton*), NSF; D, **Middlebury**, (*Brainerd*), NSF; D, **Middletown Springs**, (*Carpenter*), NSF.
- Carex saxatilis* L., O, **Mt. Mansfield**, (*Robbins et al.*), NSF; O, **Camel's Hump**, (*Tuckerman GH*), IC = *C. bigelowii*. *Carex saxatilis* and *Carex bigelowii* are somewhat similar in appearance, though only distantly related. Some 19th-century authors (i.e., Gray, 1857) treated them, incorrectly, as synonyms.
- Carex shortiana* Dewey, P, **Burlington**, "doubtful," (ex herb. *Torrey*), NSF.
- Carex sterilis* Willd., A, C, N, S, **Concord**, (*Pease NEBC*), IC = *Carex echinata* Murray; "Vermont," (*Kent NEBC*), IC = *Carex echinata*. Robinson and Fernald (1908) defined *C. sterilis*

broadly, including much of what is now called *C. echinata*. Our more restrictive use of *C. sterilis* is for a rare coastal and boreal species that does not occur in Vermont, according to Reznicek and Ball (1980) and Fernald (1950).

*Carex striata* Michx. [*C. walteriana* Bailey], T, **Burlington**, (Torrey), NSF. According to House (1924, p. 193), records of *C. striata* in Torrey's *Flora of New York* probably refer to *Carex houghtoniana* Torr. ex Dewey.

*Carex styloflexa* Buckley, A, C, S, **Middlebury**, (Brainerd VT), MI = *Carex laxiflora* Lam. or *C. gracilescens* Steudel.

*Carex tetanica* Schk., P, **Burlington**, (ex herb. Torrey), NSF.

*Carex vestita* Willd., O, **Middlebury**, (James), NSF.

*Carya tomentosa* (Poiret) Nutt. [*C. alba* (Mill.) K. Koch, not Nutt.], FL, D, **Williston**, **West Haven**, (Blake), NSF; FL, D, **Burlington**, (Burns), IC = *C. ovata* (Mill.) K. Koch. The historical synonymy of the common hickories is complex, the Linnean epithet *alba* having been used in different ways by different 19th-century authors. Some early Vermont collectors, following Gray (1857, 1874) used *C. alba* sensu Nutt. for the shagbark *C. ovata*; this apparently created confusion with the mockernut, *C. tomentosa*, which Robinson and Fernald (1908) incorrectly called *C. alba* (L.) K. Koch. Mockernuts occur in eastern N.Y., but are apparently unknown in Vermont.

*Centaurea americana* Nutt., D, **St. Johnsbury**, (Howe), NSF.

*Cerastium viscosum* L. [*C. glomeratum* Thuill.], D, **Wells River**, (Eastman), NSF.

*Chelone lyonii* Pursh, D, **Woodstock**, (Kittredge), NSF.

*Chenopodium berlandieri* Moq. var. *berlandieri*, D, **Vergennes**, **Middlebury**, (Dutton), NSF.

*Chenopodium berlandieri* Moq. var. *macrocalycium* (Aellen) Cronq. [*C. macrocalycium* Aellen], A, **Colchester**, (Flynn VT), MI = *C. berlandieri* var. *bushmanum* (Aellen) Cronq. The specimen was originally determined as *C. album* L. and annotated to *C. macrocalycium* by Wahl during his study of the genus (Wahl, 1952-3). We refer it to *C. berlandieri* var. *bushmanum*, noting that Wahl determined several other Flynn specimens from this locality, including one collected on the same day, as *C. bushianum* Aellen.

*Cimicifuga racemosa* (L.) Nutt., J, O, **Middlebury**, (James), NSF; O, **Mansfield Mountain**, (NCC), NSF; O, **Shelburne &**

**Sharpshin Points near Burlington**, (*Macrae*), NSF; D, "**Vermont**," (ex herb. *Torrey* VT), DP; "**Vermont**," (*Dike* VT), DP. The records from Middlebury, Burlington, and Mt. Mansfield are in the northern half of Vermont and are disjunct by over 100 miles from known stations of the species in other states. The Dike collection has a printed label saying "Flora of Vermont" but the collection data is handwritten and says only "*Cimicifuga racemosa* Rich Woods, 20th July, A.C. Dike." The collection from the Torrey Herbarium says only "*Actaea racemosa* Nutt. Vermont." The species is reported from within 20 miles of the southern Vermont border and could easily have occurred here; but, given the lack of detailed collection information and the possibility that the specimens may have come from cultivated plants, we cannot accept the records.

*Cirsium altissimum* (L.) Sprengel, D, **Wells River**, (*Eastman*), NSF. *C. altissimum*, a species of the southern U.S., closely resembles our *C. discolor* (Muhl.) Sprengel, which may have been the species Eastman saw.

*Cirsium canum* (L.) Bieb., D, **Castleton**, (*Higby*), NSF.

*Cirsium horridulum* Michx., P, T, **Brattleboro**, (*Frost*), NSF.

*Cirsium palustre* (L.) Scop., D, **Wells River**, (*Eastman*), NSF.

*Cirsium undulatum* (Nutt.) Sprengel, D, **Wells River**, (*Eastman*), NSF.

*Clematis viorna* L., P, T, **Castleton**, (*Carr*), NSF.

*Crataegus laevigata* (Poiret) DC. [*C. oxyacantha* L., misapplied], A, **Ryegate**, (*Blanchard* HNH), IC = *C. monogyna* Jacq.; A, **Fairlee**, (*Eggleston* HNH), IC = *C. monogyna*; A, S, **Burlington**, (*NCC* VT), CULT. Atwood (1973) lists both *C. oxyacantha* (now a rejected name) and *C. monogyna* for Vermont; earlier Vermont authors treated these names as synonyms, and the Blanchard and Eggleston specimens are in fact all *C. monogyna*.

*Crepis setosa* Haller f., EB, E, **Townshend**, (*Blanchard*), NSF; D, **Townshend**, (*Wheeler*), NSF.

*Cyperus polystachos* Rottb. [*Cyperus filicinus* Vahl], A, **many counties**, (*several collectors* VT, MO, NEBC), IC = *C. lupulinus* (Sprengel) Marcks [*C. filiculmis* Vahl var. *macilentus* Fern.]. This was probably an orthographic error, substituting *C. filicinus* (a coastal species not known inland) for *C. filiculmis*, a common Vermont plant.



- Datura metel* L., D, **Middlebury**, (*Brainerd* VT), CULT.
- Desmodium canescens* (L.) DC., O, P, **Pownal**, (*Robbins*), NSF.
- Desmodium obtusum* (Muhl.) DC. [*Desmodium rigidum* (Ell.) DC.], E, D, **North Pownal**, (*Eggleston*), NSF; E, D, **Vernon**, (*W.H. Blanchard*), NSF.
- Dianthus chinensis* L., A, **Middlebury**, (*Brainerd* VT), CULT.
- Elaeagnus angustifolia* L., A, **Westmore**, (*Dole* VT), NDN.
- Eleocharis parvula* (R. & S.) Link [*E. pygmaea* Torr.], BR, K, **Willoughby**, (*Dean* HNH), MI = *E. intermedia* (Muhl.) Schultes.
- Eleocharis rostellata* (Torr.) Torr., P, W, **Willoughby Mt.**, (*Tuckerman* NEBC), MI = *E. pauciflora* (Lightf.) Link.
- Erigeron acris* L. [*E. angulosus* Gaudin], D, **Royalton**, (*Drake*), NSF; **St. Johnsbury**, (*Pringle* VT), IC, collection from Maine. The nearest known stations are in Aroostock County, Maine. A Pringle specimen with a typed label at VT says "barren places by the St. Johnsbury RR." The label is a later addition; other, apparently identical, collections have handwritten labels which read "barren places by the St. Johns River, Me."
- Eriocaulon decangulare* L., P, **Willoughby**, (*Wood*), NSF.
- Erodium moschatum* (L.) L'Her., A, S, D, **Burlington**, (*Brainerd* VT), MI = *E. cicutarium* (L.) L'Her.; D, **Woodstock**, (*Kittridge*), NSF.
- Eubotrys racemosa* (L.) Nutt. [*Leucothoe racemosa* (L.) Gray], P, **NL**, (*NCC*), NSF.
- Eupatorium dubium* Willd., A, S, **many counties**, (*several collectors* VT, NEBC), MI = *E. purpureum* L. and *E. maculatum* L. All of the Vermont records for *E. dubium* are annotations of specimens originally determined as *E. purpureum* or *E. maculatum*. None of the annotated specimens agree with typical coastal *E. dubium* and we refer them all to their original determinations.
- Eupatorium fistulosum* Barratt, A, S, **many localities**, (*several collectors* LSC, NEBC, VT), MI = *E. maculatum* L. *Eupatorium fistulosum* is normally differentiated from *E. maculatum* by a hollow stem, fewer flowers per head, and a more convex inflorescence. Hollow-stemmed plants definitely occur in Vermont, but field and museum study (Jenkins, unpubl. data) has shown that such plants are neither more convex nor fewer-flowered than adjacent solid-stemmed plants. In addition, the hollowness of the stem is far from being a clear-

cut character. It varies in different sections of the stem and in different stems in a colony and is often mimicked by boring beetles. At present we are unable to recognize two species in our material and consider all the hollow-stemmed plants from Vermont to be forms of *E. maculatum*.

*Euphorbia geyeri* Engelm., D, **North Hero**, (*Brainerd* VT), MI = *E. nutans* Lag.

*Euphorbia humistrata* Engelm., D, **St. Johnsbury**, (*Howe*), NSF.

*Euphorbia marginata* Pursh, A, C, D, **Brandon**, (*Dutton* VT), CULT; A, **Windsor**, (*Leland* NEBC), CULT; **Burlington**, (*Flynn* VT), CULT.

*Euphorbia serpyllifolia* Pers., D, **Middlebury**, (*Brainerd*), NSF.

*Forsythia suspensa* (Thunb.) Vahl, A, **Brattleboro**, (*Wheeler* NEBC), CULT. The specimen is from Retreat Park, which has a formal garden with extensive ornamental plantings; we assume it was cultivated.

*Fragaria* × *ananassa* Duchesne [*F. grandiflora* Ehrh.], D, **Burlington**, (*Blake*), NSF.

*Galium pumilum* Murray [*Galium sylvestre* Poll.], E, D, **Charlotte**, (*Pringle* MO), MI = *G. mollugo* L.; **Charlotte**, (ex herb. *Horsford* MO), MI = *G. mollugo*.

*Gaylussacia frondosa* (L.) T. & G., D, **Wells River**, (*Smith*), NSF.

*Gentiana rubricaulis* Schwein., C, S, **Stowe**, (*Straw* VT), NSF = *G. linearis* Froelich. Dr. James Pringle (pers. comm.), who monographed the section *Pneumonanthae* of *Gentiana* (Pringle, 1967), saw the specimen at VT and annotated it to *G. linearis* Froel. The specimen is now missing.

*Geranium dissectum* L., O, **Castleton**, (*Carr*), NSF.

*Gilia tricolor* Benth., D, **Stratton**, (*Blanchard*), NSF.

*Glyceria fluitans* (L.) R. Br., D, **11 sites**, (*several collectors* VT), IC = *G. borealis* (Nash) Batch. Early Vermont botanists used the names *G. fluitans*, which is now restricted to a species of Europe and eastern Canada, and *G. septentrionalis* A. Hitchc., now restricted to a species occurring from Massachusetts south, for the common plants now referred to *G. borealis*.

*Glyceria obtusa* (Muhl.) Trin. [*Poa obtusa* Muhl.], O, P, **Bellows Falls**, (*Carey*), NSF.

*Glyceria septentrionalis* A. Hitchc., E, D, **Hartland**, (*Ruggles*), NSF; D, **North Hero**, (*Brainerd*), IC = *G. borealis* Batch.; D, **Weston**, (*Carpenter*), IC = *G. borealis*; D, **Colchester**, (*Dole*),

NSF; D, "Vermont," (*Pringle*), NSF; **East Wallingford**, (*Kent*), IC = *G. borealis*. See notes on *Glyceria fluitans* above.

*Goodyera oblongifolia* Raf. [*Goodyera menziesii* Lindl., *Epipactis decipiens* Ames], D, **St. Johnsbury**, (*Balch & Howe* SJFM), MI = *G. tessellata* Lodd.; KI, D, **Woodstock**, (*Kittredge* VINS), IS. The Woodstock collection at VINS lacks a locality or date but has a collection number matching one written in Kittredge's copy of her 1931 flora. The plant is missing from the sheet, but from the outline of the leaves remaining on the paper we believe it was *G. tessellata* or *G. repens* (L.) R. Br.

*Habenaria ciliaris* (L.) R. Br., J, O, P, **Middlebury**, (*James*), NSF; AM, **Troy**, (*Carey* MO), NSF; D, E, **Bellows Falls**, (*Carey*), NSF; A, **Troy**, (*Carey* VT), DP, MI = *H. blephariglottis* (Willd.) Hook.? *Habenaria ciliaris* was originally credited to the Vermont flora in an early list of the plants of Middlebury (James, 1823). Perkins (1888) noted, on the authority of Ezra Brainerd, that James prepared the list "in his earlier manhood and before he had acquired the botanical skill to which he afterwards attained," and that "although of great value, it nevertheless must be used with care as it contains undoubted errors." The collection cited at MO by Ames (1910) is missing. The Carey specimen at VT is labeled "*Habenaria blephariglottis*, Troy, Vt., John Carey, 1861." We reject this record for two reasons. First, *Habenaria blephariglottis* (Willd.) Hook. and *H. ciliaris*, while easily separated by color in the field, are hard to tell apart accurately when dry (Voss, 1972, p. 442). Herbarium identification rests on the length of the fringe on the lip, a character which we have found to vary considerably in other Vermont collections of *H. blephariglottis*. Because of this variability we cannot determine the specimen with certainty, but think it is probably *H. blephariglottis*. In addition, we find it hard to believe that if Carey had found a yellow-flowered *Habenaria* he would have used the name of a common white species. Second, the specimen has been remounted and the current sheet consists of portions of two older herbarium sheets, one of which bears the specimen, and the other the label data. The original papers differ in texture and composition, suggesting they are of different ages and that an error occurred when the plant was

being remounted. Thus, both the identification of the specimen and the accuracy of the label are questionable.

*Habenaria leucophaea* (Nutt.) A. Gray, D, **St. Johnsbury**, (*Howe SJFM*), MI = *H. lacera* (Michx.) Lodd.; D, **Danville**, (*Howe & Balch TUFT*), MI = *H. psycodes* (L.) Sprengel.

*Hieracium gronovii* L., T, **Colchester**, (*Torrey VT*), MI = *H. scabrum* Michx.; T, **Brattleboro**, (*Frost*), NSF; D, **Woodstock**, (*Kittredge*), NSF.

*Hydrangea arborescens* L., D, **Burlington**, (*Dole*), NSF.

*Iberis amara* L., A, **Peacham**, (*Blanchard HNH*), NDN.

*Ilex laevigata* (Pursh) A. Gray, T, **mouth of Winooski River**, (*NCC*), NSF; C, LI, **Rutland Co.**, (*NCC*), NSF; **Charlotte**, (*Eggleston HNH*), MI = *I. verticillata* (L.) A. Gray.

*Ipomoea coccinea* L., D, **Burlington**, (*Mrs. Zottman*), NSF.

*Ipomoea quamoclit* L. [*Quamoclit vulgaris* Chosey], A, **Windsor**, (*Leland NEBC*), CULT. The specimen has two labels. The original label says "habitat gardens"; a second label, covering the first, says "garden escape."

*Isatis tinctoria* L., P, **Burlington**, (*NCC*), NSF.

*Juglans nigra* L., D, **Leicester**, (*Dutton*), NSF; A, C, S, **West Dover**, (*Eaton NEBC*), MI = *J. cinerea* L.; "**Railroad Street**," (*Roony SJFM*), NDN.

*Juncus brachycarpus* Engelm., A, **Caledonia Co.**, (*Seymour*), NSF.

*Lamium album* L., D, **St. Johnsbury**, (*Howe*), NSF; D, **Burlington**, (*Flynn VT*), MI = *L. maculatum* L.

*Lappula redowskii* (Hornem.) Greene, A, **Williston**, (*Bates GH*), MI = *L. squarrosa* (Retz.) Dumort [*L. echinata* Gilib.].

*Lechea maritima* Leggett, A, C, S, **Burlington**, (*Flynn VT*), MI = *L. intermedia* Leggett; A, C, S, **Burlington**, (*Charette*, det. A. R. Hodgdon, MO, HNH), MI = *L. intermedia*; A, C, S, **Essex**, (*Charette VT*), MI = *L. intermedia*; A, C, S, **Essex**, (*Brainerd VT*), MI = *L. intermedia*. *Lechea maritima* is, to us, a poorly delimited species. The characteristic pubescence of coastal plants is not present on inland material that we have seen, making *L. maritima* difficult to separate from *L. intermedia* without mature seeds. The inland range of *L. maritima* is, correspondingly, uncertain. When Hodgdon reviewed the genus (Hodgdon, 1938) he found no valid records from Vermont, though subsequently he identified Charette's 1969 Burlington collection as *L. maritima*. This specimen appears to

us to fall within the range of variation of the Vermont specimens of *L. intermedia* and we refer it to that species.

*Lepidium ruderale* L., P, **Rutland**, (*Pringle*), NSF; D, **Leicester Junction**, (*Brainerd*), NSF; **Lyndonville**, (*Bahosh* LSC), MI = *L. virginicum* L.; **Brighton**, (*Trafan* LSC), IS; **Burlington**, (*Cook, Grout* VT), MI = *L. densiflorum* Schrader.

*Lespedeza procumbens* Michx., D, “**Vermont**,” (*NCC*), NSF.

*Ligustrum obtusifolium* Siebold & Zucc., A, **Burlington**, (*Dole* VT), NDN. The sheets are labeled: “*in series sepium*” (in hedge rows), but this does not make it clear whether they are cultivated or escaped.

*Linum grandiflorum* Desf., D, **Brandon**, (*Dutton* VT), CULT; D, **Middlebury**, (*Brainerd* VT), CULT.

*Lithospermum latifolium* Michx., D, **Colchester**, (*D.B. Griffin*), NSF.

*Luzula confusa* Lindeberg, C, S, **Rutland**, (*Eggleston* CONN), IC. The label on the specimen reads: “Mt. Washington, N.H., ex herb. W. W. Eggleston of Rutland.”

*Lycopus europaeus* L., P, “**not very common**,” (*NCC*), NSF.

*Lycopus rubellus* Moench, D, **Bennington**, (*Ridlon*), NSF; A, D, **Burlington**, (*Dole*), NSF; A, S, **Lyndon**, (*Pease* NEBC), MI = *L. americanus* Muhl.; A, S, D, **Willoughby**, (*Kennedy* NEBC), MI = *L. americanus*; A, **Colchester**, (*Dole* VT), MI = *L. americanus*; A, **Benson**, (*Atwood* VT), MI = *L. americanus*. A range map in a review of this species by Henderson (1962) shows no Vermont occurrences.

*Macleaya cordata* (Willd.) R. Br., D, **Proctor**, (*Kittredge*), NSF.

*Matricaria recutita* L. [*M. chamomilla* L.], D, **St. Johnsbury**, (*Howe*), NSF.

*Matthiola incana* (L.) R. Br., A, **Peacham**, (*Blanchard* HNH), CULT.

*Melothria pendula* L., D, **Burlington**, (*Flynn* VT), CULT.

*Mertensia virginica* (L.) Pers., E, D, **Burlington**, (*Gifford*), NSF; D, **Fair Haven**, (*Carpenter*), NSF; S, **Burlington**, (*Jones* VT), NDN. This is a common cultivar. The Jones collection says “old cellar hole” and provides no evidence that the plant has spread beyond the area where it was cultivated.

*Mimulus alatus* Aiton, D, **Wells River**, (*Smith*), NSF.

*Mimulus guttatus* DC. [*M. langsdorfii* Donn], D, **Reading**, (*Whiting*), NSF.

- Muhlenbergia racemosa* (Michx.) BSP., A, S, **Westmore**, (*Stevens* HNH), MI = *M. mexicana* (L.) Trin.; A, S, **Westmore**, (*Dean* HNH), IC = *M. glomerata* (Willd.) Trin.; A, S, **Norwich**, (*Jesup* HNH), IC = *M. glomerata*; KS, **Hartland**, (*Ruggles* HNH), IC = *M. glomerata*. The name *M. racemosa*, which formerly included the Vermont plants now referred to *M. glomerata*, is now restricted to a western species.
- Muscari botryoides* (L.) Miller, D, "**occasional**," (*NCC*), NSF; A, S, **Peacham**, (*Blanchard* HNH), CULT; A, S, **Charlotte**, (*Pringle* VT), CULT; **North Street**, (*Carpenter* VT), DP, NDN. This is a common cultivar which, although naturalized elsewhere in the northeast, has not been found wild in Vermont. The Carpenter specimen lacks a town or a state and was not cited in any floras; it may well be a Vermont collection, but cannot be accepted without corroborating evidence.
- Myriophyllum heterophyllum* Michx., P, **NL**, (*NCC*), NSF.
- Nelumbo lutea* (Willd.) Pers., D, **Champlain Valley**, (*Brainerd*), NSF.
- Oenothera biennis* L. var. *canescens* T. & G. [*O. canescens* Torr. & Frem.], D, **Woodstock**, (*Kittredge*), MI = *O. parviflora* L. var. *oakesiana* (Robbins) Fern.
- Oenothera fruticosa* L., T, **Willoughby**, (*Frost*), NSF; S, **Danville**, (*NNC* VT), NSF.
- Panicum amarum* Elliott, P, **Brattleboro**, (*Barrett, Robbins & Pringle*), NSF.
- Panicum polyanthes* Schultes, D, **Leicester**, (*Dutton*), NSF.
- Panicum spretum* Schultes, A, S, **Townshend**, (*Dobbin* MO), MI = *P. lanuginosum* Ell.
- Papaver dubium* L., P, **NL**, (*NCC*), NSF; **Charlotte**, (*Pringle* VT), CULT.
- Papaver intermedium* Becker, EB, **Townshend**, (*Blanchard*), NSF. This name, taken from the original publication, is apparently no longer in use. We have been unable able to determine its modern equivalent.
- Penstemon laevigatus* Aiton [*Penstemon calycosus* Small], A, S, **five counties**, (*several collectors* VT, NEBC), MI = *P. digitalis* Nutt.; PE, **near Poultney**, (*Drushel* PH), MI = *P. digitalis*.
- Petrorhagia saxifraga* (L.) Link [*Tunica saxifraga* (L.) Scop.], D, **Morrisville**, (*Bentley*), NSF.
- Petroselinum crispum* (Miller) Mansf., A, **Townshend**, (*Wheeler* NEBC), CULT; A, **Caledonia Co.**, (*NCC* NEBC), NSF.

- Phlox drummondii* Hook., A, **Peacham**, (*Blanchard* HNH), NDN.  
*Physalis peruviana* L., E, D, **Burlington**, (*Jones* VT), MI = *P. pubescens* L.; D, **Hinesburg**, (*Roy* VT), MI = *P. heterophylla* Nees.
- Plantago virginica* L., T, **Brattleboro**, (*Frost*), NSF.
- Poa alpina* L., O, **Mt. Mansfield summit**, (*Robbins*), NSF. *Poa alpina*, a species of the subarctic, closely resembles our *Poa fernaldiana* Nannf. The latter occurs on Mt. Mansfield and may be the species that Robbins saw.
- Polygonum ramosissimum* Michx., A, **Manchester**, (*Day* VT), MI = *P. aviculare* L.; BR, “frequent,” (*NCC*), MI = *P. aviculare* (*Eggleston and Brainerd*, 1904).
- Potamogeton pulcher* Tuckerman, P, **Brattleboro**, (*Frost*), NSF.
- Prenanthes nana* (Bigel.) Torr. [*P. trifoliolata* (Cass.) Fern. var. *nana* (Bigel.) Fern.], E, **Willoughby Mt.**, (*Rusby*), NSF.
- Prenanthes racemosa* Michx., D, F, **Swanton**, (*Blake*), NSF.
- Primula veris* L. [*P. officinalis* (L.) Hill], D, S, **Burlington**, (*Jones*), NSF.
- Prunus avium* L., A, S, D, **Manchester**, (*Day* NEBC), MI = *P. cerasus* L.
- Prunus cerasifera* Ehrh., A, **Franklin Co.**, (*NCC* NEBC), NSF.
- Prunus persica* (L.) Batsch., A, **Jamaica**, (*Wheeler* NEBC), CULT.
- Pycnanthemum setosum* Nutt. [*P. aristatum* Michx.], P, **Southern Vermont**, (*NCC*), NSF.
- Pyrus baccata* L., D, **St. Johnsbury**, (*Miss Howe*), NSF.
- Pyrus prunifolia* Willd., A, S, **Worcester**, (*Blanchard* NEBC), NDN.
- Quercus palustris* Muenchh., D, **Pittsford**, (*Dutton*), NSF.
- Quercus prinoides* Willd., BR, D, E, **Pownal**, (*several collectors* VT, NEBC, HNH, NCU), MI = *Q. muehlenbergii* Engelm.; A, S, **Addison**, (*Brainerd* VT), MI = *Q. muehlenbergii* and hybrids. The leaves of *Q. prinoides*, a species of sandplains in southern and central New England, are very similar to those of *Q. muehlenbergii*, a species of limy hills and ledges that is uncommon but widely distributed in western Vermont (*Zika*, 1986A). Well-developed leaves of *Q. muehlenbergii* are typically larger and have more teeth than those of *Q. prinoides*. Leaves of intermediate form are common in both species, and some authors (i.e., *Gleason*, 1952) consider *Q. muehlenbergii* an arborescent variety of *Q. prinoides*. Collections of *Q. prinoides* from Quarry Hill in Pownal lack bark and habit notes. They cannot be determined with certainty,

though many suggest *Q. muehlenbergii* more strongly than *Q. prinoides*. Quarry Hill is a limestone hill, and has an extant population of *Q. muehlenbergii*; hence we refer all the historical collections from Quarry Hill to that species. Specimens from Snake Mountain in Addison also lack notes and are likewise undeterminable. The plants there, which were recently relocated, are in a calcareous site and are typically low and multi-stemmed but occasionally have strong single trunks several meters high. Their leaves are exceptionally variable, some suggesting *Q. prinoides*, some *Q. muehlenbergii*, and some seemingly hybrids with *Q. prinus* L., which occurs nearby. Given the variability we are reluctant to name this population. But we do not think that the Snake Mountain plants, viewed as a group, are sufficiently distinct from the typical *Q. muehlenbergii* of the Champlain Valley, or sufficiently similar to the typical *Q. prinoides* of southern New England, to be the basis of a new state record and northward range extension for *Q. prinoides*.

*Ranunculus micranthus* Nutt., A, D, E, **Coventry**, (*Cushman* HNH), MI = *R. abortivus* L.

*Reseda odorata* L., S, **Windsor**, (*Leland* NEBC), CULT. As with *Ipomoea quamoclit*, the original label (now covered by a second label) says "garden plant."

*Ribes nigrum* L., A, S, D, **Townshend**, (*Wheeler* VT), CULT; **Dummerston**, (*Wheeler* NEBC), IS; **Wallingford**, (*Kent* NEBC), IS; **Newport**, (*Knowlton* NEBC), IS (sterile). Good flowering material is needed to distinguish this species from *R. americanum* Miller.

*Rosa* × *alba* L., D, **Townshend**, (*Wheeler*), NSF; D, **Stratton**, (*Underwood*), NSF; D, **Leicester**, (*Dutton*), CULT.

*Rosa canina* L., D, **Woodstock**, (*Wright*), NSF; D, **Johnson**, (*Grout* VT), IC = *R. pimpinellifolia* L. [*R. spinossisima* L.]. The specimen was originally determined as *R. canina*, then annotated, correctly, to *R. spinossisima*. Later it was cited, incorrectly, as *R. canina*.

*Rosa damascena* P. Mill., D, **Norwich**, (*Loveland*), NSF; D, **Leicester**, (*Dutton*), CULT.

*Rosa johannensis* Fern., A, S, **North Hero**, (*Knowlton* NEBC), MI = *R. blanda* Ait.; A, S, **Gardiner Island**, (ex herb. *Faxon* NEBC), MI = *R. blanda*; A, S, **Royalton**, (*Eggleston* NY), MI = *R. blanda*; A, S, **Ferrisburg**, (*Faxon et al.* NY), MI = *R. blanda*. *Rosa johannensis* is a species of uncertain status



that may eventually be included in *R. blanda*. Whatever its final disposition, all the Vermont specimens seem to be typical *R. blanda*.

*Rosa tomentosa* J. E. Smith, D, **Woodstock**, (*Kittredge*), NSF; D, **Pomfret**, (*Kittredge*), NSF.

*Rumex altissimus* Wood, A, **Windham Co.**, (*NCC VT*), NSF.

*Rumex aquaticus* L., P, **near summit of Mt. Mansfield**, (*NCC*), NSF. *Rumex longifolius* DC. was found as a weed near the summit of Mt. Mansfield before 1900, and handwritten notes in the copy of Perkins (1888) used to prepare the Brainerd et al. (1900) flora suggest that this is the species to which Perkins was referring.

*Rumex arifolius* All. [*Rumex montanus* Desf.], D, **Burlington**, (*Ross VT*), MI = *R. acetosa* L.

*Rumex patientia* L., A, **5 counties**, (*several collectors HNH, VT*), IC = *R. longifolius* DC. [*R. domesticus* Hartm.]. Early Vermont botanists, following the Seventh Edition of *Gray's Manual* (Robinson and Fernald, 1908), used the name *R. patientia* for the plants we now call *R. longifolius*. True *R. patientia* occurs in the northeastern U.S., but apparently not in Vermont.

*Sagittaria lancifolia* L. [*S. falcata* Pursh], T, **Brattleboro**, (*Frost*), NSF; P, **Mallets Bay, Colchester**, (*NCC*), MI (see Brainerd et al., 1900). A review by Bogin (1955) lists no occurrences of this species north of Delaware.

*Sagittaria subulata* (L.) Buch. [*S. natans* Michx.], P, T, **Brattleboro**, (*Frost*), NSF.

*Salix pentandra* L., D, **Burlington**, (*Dole*), NSF.

*Salix serissima* (L. H. Bailey) Fern., A, D, S, **Arlington**, (*Knowlton NEBC*), IS; A, S, **Corinth**, (*Anderson NEBC*), NSF; A, **Franklin Co.**, (*NCC HNH*), MI = *S. lucida* Muhl.; **Westmore**, (*Churchill HNH*), MI = *S. lucida* Muhl. Young sterile shoots of *Salix serissima* are hard to distinguish from *S. lucida* and cannot be determined with certainty. We expect that *S. serissima* will eventually be found in Vermont, but, as yet, do not have confirming specimens.

*Saururus cernuus* L., **Bristol**, (*Dike VT*). The specimen is correctly identified but is uncorroborated by written citations or other collections from Vermont and is probably mislabeled. Geographically, *Saururus cernuus* is a southern species that reaches its northern range limits in southern Massachusetts and western New York. Bristol is ca. 150 miles from the nearest

stations in western New York and 200 miles from the nearest colonies in southern New England and the Hudson Valley. This is a substantial disjunction: out of ca. 250 species which reach their northern range limits in Vermont, only six are disjunct by more than 75 miles from the nearest colonies in other states, and only three of these by ca. 100–125 miles (Jenkins, in prep.). The wetlands in Bristol—which are only 20 miles from Burlington—were a famous botanical site and received the attention of all the prominent Vermont botanists of Dike's day, especially Pringle and Brainerd. In addition, Dike traded specimens with Pringle and others. It seems likely to us that the discovery of a conspicuous and exceedingly rare species would have been noted and verified by other botanists and would have been cited in print. Given the geographic implausibility and the absence of any corroborating citations or specimens, we consider it likely that the specimen was mislabeled.

*Sedum telephioides* Michx., D, **Colchester**, (*Flynn* VT), MI = *S. telephium* L.; D, **Burlington**, (*Dole*), NSF.

*Silene caroliniana* Walter [*S. pennsylvanica* Michx.], D, **Wells River**, (*Smith*), NSF.

*Sisyrinchium albidum* Raf., P, **NL**, (*NCC*), NSF.

*Smilax glauca* Walter, D, **Clifton**, (*Britton* VT), DP. There is no Clifton in Vermont. Britton made a number of collections from Clifton, N. Y., on Staten Island.

*Smilax rotundifolia* L., O, P, **NL**, (*NCC*), NSF.

*Solanum tuberosum* L., A, **Newfane**, (*Wheeler* NEBC), NDN.

*Solanum villosum* Miller, S, **Westford**, (*Munier* VT), MI = *S. sarrachoides* Sendtner.

*Solidago calcicola* Fern., C, CR, S, **Mt. Killington**, (*Dutton et al.* VT, GH, NEBC), MI = *S. macrophylla* Pursh × *rugosa* Aiton. The specimens were probably from a single plant. The original collectors took them to Fernald who first determined them as *S. calcicola* (Kirk, 1912A, 1912B), then compared them to the northern material he was calling *S. calcicola* and changed his mind (Anonymous, 1915).

*Solidago rigida* L., T, **Burlington**, (*Torrey*), NSF.

*Solidago stricta* Aiton, T, **Burlington**, (*Torrey*), NSF.

*Spartina alterniflora* Loisel, D, **Vermont**, (*Pringle*), NSF. Given the lack of any citations in other floras we regard it as improbable that Dole ever saw a Pringle sheet of either this or the next.

- Spartina patens* (Aiton) Muhl., D, **Vermont**, (*Pringle*), NSF.
- Sphenopholis pensylvanica* (L.) A. Hitchc. [*S. palustris* Scribn., *Trisetum pensylvanicum* (L.) Beauv.], A, S, **Wells River**, (*Jones VT*), NSF. References to *Avena pensylvanica* L. or *Eatonia pensylvanica* A. Gray in early floras (i.e., Brainerd et al., 1900) refer to *S. intermedia* (Rydb.) Rydb. and not *S. pensylvanica*.
- Spiraea japonica* L. f., D, **Woodstock**, (*Kittredge*), NDN; **Pea-cham**, (*Blanchard NY*), NDN, MI = *Astilbe japonica* (Morren & Decne.) A. Gray.
- Spiraea prunifolia* Siebold & Zucc., A, **Middlebury**, (*Brainerd VT*), NDN. Brainerd collected this species in 1898 but did not list it in his flora (Brainerd et al., 1900), suggesting that the collection was from a cultivated plant.
- Stellaria longipes* Goldie [*Stellaria strictiflora* (Rydb.) J. M. Macoun], D, **Woodstock**, (*Porter*), MI = *S. graminea* L.; D, **Plymouth**, (*Heselton*), NSF; D, **Passumpsic**, (*Howe*), NSF; D, **Weston**, (*Carpenter*), NSF.
- Thalictrum revolutum* DC. [*T. purpurascens* L. of Robinson and Fernald (1908) in part], KI, D, **Woodstock**, (*Kittredge VINS*), MI = *T. dioicum* L.; D, **Clarendon**, (*Hitchcock NY*), MI = *T. pubescens* Pursh.
- Thaspium trifoliatum* (L.) A. Gray [*T. aureum* Nutt., misapplied; *Thaspium aureum* var. *aptera* A. Gray], P, “**common in damp fields**,” (*NCC*), NSF. The treatments of *Thaspium* and *Zizia* are extremely confused in 19th-century manuals (i.e., Gray, 1874). Perkins was probably referring to *Zizia aurea* (L.) Koch.
- Tipularia discolor* (Pursh) Nutt., P, **Brattleboro**, (*Frost*), NSF; P, “**Vermont**,” (*Beck*), NSF; D, **Bradford**, (*Bacon*), NSF. Perkins (1888) called the early records doubtful. Despite the lack of a specimen or corroborating documentation, *Tipularia* was put on the official Vermont list of protected plants (13 V. S. A., Chapter 79) in the 1930’s.
- Tradescantia subaspera* Ker Gawler, A, S, D, **Hartland**, (*Carpenter VT*), MI = *T. virginiana* L.
- Trifolium medium* L., D, **Wells River**, (*Eastman*), NSF; D, **Burlington**, (*Jones*), NSF.
- Trifolium stoloniferum* Muhl., P, **Bellows Falls**, (*Brown*), NSF. See Brooks (1983).
- Viburnum prunifolium* L., D, **Ferrisburg**, (*Kittredge*), NSF.
- Viola brittoniana* Pollard, D, **Vermont**, (*Dutton*), NSF.
- Viola elatior* Fries., D, **Wells River**, (*Eastman*), NSF, NDN.

*Viola odorata* L., A, S, **Jamaica**, (*Wheeler* NEBC), NDN; **Middlebury**, (*Brainerd* HNH), CULT; **Norwich**, (*Richardson* HNH), NDN.

*Viola pedata* L., T, **Brattleboro**, (*Frost*), NSF.

*Viola striata* Aiton, A, S, **Middlebury**, (*Brainerd* VT), NSF.

*Vitis vulpina* L. [*V. cordifolia* Michx.], P, **NL**, (*NCC*), NSF.

*Woodsia oregana* D.C. Eaton, B, G, **Charlotte**, (*Pringle* IA), CULT.

*Zizia aptera* (Gray) Fern. [*Zizia cordata* (Walt.) DC., *Thaspium trifoliatum* Gray var. *apterum* Gray, ? *T. cordatum* T. & G.], P, **NL**, (*NCC*), NSF; O, **Middlebury**, (*James*), NSF. The treatments of *Thaspium* and *Zizia* are extremely confused in 19th-century manuals (i.e., Gray, 1874), and we are not sure what species Perkins and Oakes had in mind.

#### DISCUSSION

##### The rate of additions

How fast are species being added to the Vermont flora? Our manuscript checklist (Jenkins and Zika, in prep.) lists 1933 species for Vermont, of which 1310 (68%) are believed to be native. In the last 19 years approximately 19 native species and 58 aliens have been added to the flora, or roughly three aliens for every native species. These numbers give a growth rate of 0.2% per year for the whole flora, 0.08% for the native species, and 0.5% per year for the alien species, with the pool of aliens growing six times faster than the pool of native species.

These numbers show that there are still discoveries to be made in a flora which, by United States standards, is very well-known. If the present discovery rate continues, the number of native species reported will grow by nearly 10% in the next century, the number of aliens by a remarkable 50%, and the whole flora by approximately 20%.

The continuing discovery of new species, after 150 years of botanical effort, raises the question of whether the newly discovered plants are recent immigrants or resident species that have been overlooked. This is an impossible question to answer factually, but we can advance three indirect arguments that support the hypothesis that many of the newly discovered species are new arrivals.

(1) Approximately 620 species of aliens have immigrated to Vermont in about 230 years of European settlement. The average

immigration rate was 2.7 species per year and the peak immigration rate has to have been larger than this. The current discovery rate (about 3.0 alien species per year) is roughly the same as the average immigration rate and so it is at least possible that many discoveries are recent immigrants.

(2) The discovery rate for all species declined six-fold from about 20 species per year in the late 1800's to a rate of two to three species per year by the middle of this century. If we were exhausting a fixed pool of undiscovered species, we would expect the decline would have continued and that the current discovery rate would be lower than the mid-century rate. But instead, it has increased slightly to about four species per year (Jenkins and Zika, in prep.). This suggests either that the depletion of the pool of undiscovered species is being offset by increased botanical effort or that the pool is being replenished through immigration.

(3) Many of the newly discovered species, both natives and aliens, are colonizing species found in successional or human-disturbed habitats. In such habitats, individual populations of rare species are almost always transient; we have only a few documented examples (e.g., *Lygodium palmatum* (Bernh.) Swartz, *Ceanothus herbaceus* Raf.) of rare species that have persisted for more than a decade or two in successional habitats. Probably many of the newly arrived species in such habitats neither persist nor establish elsewhere (Pimm, 1991; Muhlenbach, 1979). The remainder spread, often rapidly, as *Puccinellia distans* (Jacq.) Parl. and *Panicum dichotomiflorum* Michx. have recently done (Zika, 1990) or as *Cardamine impatiens* L. and *Carex praegracilis* W. Boott appear to be doing (Jenkins, pers. obs.; Reznicek and Oldham, 1993). This suggests that it is likely that many of the species that are both rare and restricted to transient habitats are fairly recent arrivals.

None of the above arguments proves that the newly discovered species are recent immigrants, but, taken together, they at least make it plausible.

### **The plausibility of unvouchered records**

We have deleted 130 unvouchered taxa from the flora. It is likely that some of these excluded taxa (for example, *Carex crawei* Dewey, which Perkins reports on the basis of a collection by C. G. Pringle from Charlotte (Perkins, 1888)) are valid records. Giv-

en that Pringle knew sedges well and was a scrupulous collector, that good habitat for the species exists in Charlotte, and that the species occurs on the New York side of Lake Champlain within 20 miles of Charlotte, it seems quite likely to us that a specimen once existed and has since been lost.

With equal certainty, some of the unvouchered records are invalid. The record of *Erigeron acris* L. from Royalton, Vermont, 300 miles south of the nearest vouchered colony and mentioned only in a flora (Dole, 1937) whose compilers did not require specimens, is almost certainly a mistake.

By rejecting unvouchered records, we thus guard against mistakes; but, at the same time, we exclude some authentic records for which the validating specimens have been lost. This is common botanical practice and is amply justified if our chief purpose is to avoid mistakes or, for that matter, to tabulate as accurately as possible the current holdings of botanical museums. But if our purpose is to make the most accurate possible list of the historical flora of the state and if, on the average, more of the unvouchered records are right than wrong, we will improve our overall accuracy by including them, albeit at the cost of including some mistakes as well. But are more of the unvouchered records right than wrong?

A review of the geography of the unvouchered records strongly suggests that they are not. Of the 85 native species with one or more unvouchered records, only 15 are known from sites within 100 miles of their reported Vermont locality. The remaining 70 (82%) are long disjuncts. This contrasts with an overall frequency of less than 3% for long disjuncts among the 1310 native species that we currently list for Vermont (Jenkins and Zika, in prep.). Thus, the frequency of long disjunctions is 27 times higher among unvouchered than vouchered records, suggesting that many of them are geographically suspect.

The geographic plausibility of the 45 species of unvouchered aliens is more difficult to evaluate. Since long disjunctions are common in weedy species and since most cultivars are potentially able to escape, any alien species occurring or cultivated in the northeast U.S. might conceivably occur in Vermont. With this interpretation of what is geographically possible, 21 of the unvouchered aliens are regarded as possible because they are cultivars, 16 are regarded as possible because they have occurred as introductions in the northeast, and 8 are neither cultivated nor escaped regionally and so unlikely on geographic grounds.

Table 1. Approximate error rates in previous Vermont floras relative to current knowledge

	Date of Flora						
	1853	1888	1900	1915	1937	1969	1973
Total Species <sup>a</sup>	1034	1360	1563	1694	1861	1927	1990
Species we delete <sup>b</sup>	27	33	4	15	101	40	58
Possible error rate (%) <sup>c</sup>	2.6	2.4	0.3	0.9	5.4	2.1	2.9

Notes: <sup>a</sup> Number of species in flora, not corrected to current taxonomy. <sup>b</sup> Number of species from that flora we have deleted in this article. <sup>c</sup> Number of species deleted divided by number species in flora, in percent.

Combining natives and aliens, 78 of the 130 unvouchered records (60%) are geographically unlikely. Fifteen (12%) are geographically plausible native species and 37 (28%) are cultivars or rare weeds which we also consider geographically plausible. Thus at least three-fifths of the unvouchered records are geographically unlikely and most probably based on misidentifications. This suggests that the inclusion of unvouchered records would add a substantial number of misidentifications (at least 78 and possibly as many as 130) to the Vermont flora and substantially decrease the overall accuracy of the flora.

This conclusion is strengthened by the observation that in the last 14 years of field work Vermont botanists rediscovered about 100 of the 200 vouchered native species that were considered missing in 1980 (50%), but only two out of the 83 missing unvouchered natives (2.4%). This means that either unvouchered native species are about 20 times harder to relocate than vouchered ones, or that 20 times more unvouchered native species have gone extinct than vouchered ones, or that many of the unvouchered species have never been here at all.

### The completeness and accuracy of historical floras

Every flora has errors and omissions. The existence of seven previous Vermont floras gives us a rare opportunity to examine these quantitatively (Table 1). By using our manuscript checklist (Jenkins and Zika, in prep.) as a benchmark, we can calculate the percentage of the species we accept that are included in each previous flora, and also the ratio of the records we would delete

from a previous flora to the total number of species in it (possible error rate). Note that we do not count changes in taxonomic rank as omissions or errors. We call the ratio a *possible* error rate because we may have erred in some of our re-determinations of historical specimens and because some percentage of the unvouchered records we are deleting may be valid. It is thus an estimate of the upper bound of the percentage of species erroneously credited to the flora.

Table 1 presents the results. The most interesting thing to note is that while the percentage of the 1992 flora included has increased with each successive flora, the possible error rate has sometimes increased and sometimes decreased. Newer is not necessarily better. The nineteenth century floras had a respectable possible error rate of about 2.5%, largely the result of misidentifications and taxonomic uncertainties, but included approximately 52% and 68% of our checklist flora (Jenkins and Zika, in prep.<sup>4</sup>). The two floras early in this century, which were based entirely on vouchers and prepared with great attention to taxonomic detail, included approximately 83% of our checklist flora and had impressively low possible error rates of 0.3% and 0.9%. The 1937 flora included 85% of the species we currently recognize; but it mixed vouchered and unvouchered records and so had a possible error rate of 5.4%, the highest of any Vermont flora. The 1969 flora and 1973 checklist, following a period of relative botanical inactivity, still increased the known Vermont flora to approximately 93% of our checklist flora total and improved the accuracy of the flora by eliminating many unvouchered records that had been reported in 1937. But in many cases the compilers of these works transcribed rather than verified label data and so introduced a number of misidentifications, nomenclatural errors, and inaccurate citations. In consequence, the 1969 flora and 1973 checklist have possible error rates of 2.1% and 2.9%, roughly half those of the 1937 flora, but several times higher than those of the more scrupulous 1900 and 1915 floras.

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<sup>4</sup> Estimates of the percent of our checklist flora included in an historical flora are made by taking the number of species in that flora (top line of Table 1), subtracting the number of species we are deleting (second line of Table 1), and then correcting for differences in taxonomic concepts. For example, the 1937 flora had 1861 species. We delete 102 of these, then subtract 125 species that we do not recognize, and add three species formerly considered varieties. The result is 1637 species, or 84.6% of our checklist total of 1933 species.



We close with several comments about floristic practice. First, Table 1 confirms what many botanists have long suspected: attempting to base a flora on unvouchered field records is a risky business. The Vermont floras that included unvouchered records (1853, 1888, 1937) had apparent error rates of 2.4% to 5.4%, meaning that anywhere from one species in 42 to one species in 19 in these works might be erroneously attributed to the flora. Second, owing to nomenclatural changes and the inevitable misidentifications found in all herbaria, attempting to do a flora by compiling herbarium records without verifying the nomenclature and the identifications is likewise risky. The recent Vermont floras that did this (1969, 1973) had apparent error rates of 2.1% and 2.9%, lower on average than those that accepted unvouchered records, but still suggesting that one species in 34 to one in 48 was erroneously attributed to the flora.

And finally, as has been forcefully stated by E. Voss (1972, p. 3, 7–8), given the inaccuracies in previous floras, it follows that any attempt to compile a state or regional checklist by combining several previous floras without examining primary records is likely to be highly inaccurate. If we were to compile a checklist of the flora of Vermont in this way, it would contain about 2125 species. One hundred ninety-two of these would rest on unvouchered or otherwise unacceptable records, for a possible error rate of nine percent, or one species in 11.

Thus, our conclusion, which is hardly radical, is that the practice of basing floristic work on the critical examination of vouchers seems amply justified. Such work in Vermont has produced error rates six to eighteen times lower than those of less critical works and approximately thirty times lower than what might be produced by compiling printed records.

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